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ABSTRACT

This study examined students' attitudes towards the use of computer technology in composition instruction. Subjects were 122 college juniors and seniors enrolled in seven sections of a technical writing course. Students received either 10 weeks of computer assisted instruction (CAI) in a computer environment, 5 weeks of CAI in a computer environment and 5 weeks in a traditional classroom, or 10 weeks of a paper version of the CAI in a traditional classroom. A 57-item attitude inventory was used to measure the students' attitudes towards the course, collaboration, conferencing, and computers/CAI. Results showed differences in groups' attitudes towards organizing their thoughts, evaluating peers' work, time spent revising, amount of pre-writing, amount of course work, in-class computer time, writing tasks, and outside-of-class work. The results suggest a possible process to follow when designing tools to evaluate students' attitudes towards computer implementation. (8 tables and 20 references) (Author/EW)

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Implementing Computer-Assisted-Instruction in a Technical Writing Course: Effects on Students' Attitudes

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February, 1989

Running Head: CAI: Effects on Students' Attitudes

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Abstract

This study examined students' attitudes towards the use of computer technology in composition instruction. Subjects for the study were 122 college juniors and seniors enrolled in seven sections of a technical writing course. Students received either 10 weeks of CAI in a computer environment, 5 weeks of CAI in a computer environment and 5 weeks in a traditional classroom, or 10 weeks of a paper version of the CAI in a traditional classroom. A 57-item attitude inventory was used to measure students' attitudes towards the course, collaboration, conferencing, and computers/CAI. Results showed differences in the groups' attitudes toward the following: organizing thoughts, evaluating peers' work, time spent revising, amount of pre-writing, amount of course work, in-class computer time, writing tasks, and outside-of-class work. Our results reveal a possible process to follow when designing tools to evaluate students' attitudes toward computer implementation.

Implementing Computer-Assisted-Instruction in a Technical Writing Course: Effects On Students' Attitudes

INTRODUCTION

Composition instruction and computer technology are converging. Wresch [1] lists six reasons why instructors use computer-assisted-instruction (CAI) in composition instruction. He states that CAI 1) offers individualized instruction, 2) helps when it is most needed, 3) provides analysis features, 4) uses students' time effectively, 5) helps students move text, and 6) allows more freedom to write. Along with this convergence occurs a change in curriculum development.

Balestri and Ehrmann [2] suggest that teachers who use CAI develop a curriculum which promotes learning by designing. They feel teachers should not only be evaluators of final drafts, but should also coach students throughout the writing process using techniques such as collaborative learning and conferencing. They suggest that teachers should not only lecture on writing skills, but also provide students with word processor and CAI experience. The CAI should allow students to use a computer creatively in designing documents. Most importantly, Balestri and Ehrmann feel that it is critical to attend to other areas of research, such as the attitudes of those students who use CAI. While current research on computers and writing focuses on conferencing [3], collaboration [4], and word processing [5], in our review of this literature we did not locate any research which focused on evaluating students' attitudes towards the use of CAI in composition instruction.

Balestri and Ehrmann's [2] concern with evaluating students' attitudes is rooted in a

long history of social psychologists' concerns with measuring attitudes and understanding their importance. Fishbein and Ajzen [6] describe attitudes as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" [6, p.6]. They also note that such an evaluative dimension is frequently regarded as the most distinctive feature of an attitude. It is this quality of evaluating an object and deciding if one likes or dislikes it, that is the distinguishing characteristic of an attitude.

At the University of Minnesota (St. Paul campus), we regularly use CAI in the composition classroom; therefore, we wanted to investigate our students' attitudes towards CAI. This information is important because it indicates whether students intend to use skills acquired via CAI in their future writing. Specifically, this study was designed to evaluate students' attitudes toward the course, collaboration, conferencing, and computers in relation to the use of CAI in different instructional environments.

LITERATURE REVIEW

Prior to designing an attitude inventory, we searched current literature in the four areas noted above: technical writing course curricula, collaboration, conferencing, and computers.

Technical Writing Course Curricula

In this area, we reviewed research on the success or failure of documentation for the world-of-work. Numerous researchers such as Anderson [7], Duffy [8], and Tebeaux [9] note that the failure of a document most often results from an author's failure to adequately analyze his or her audiences, purposes, and intended effects prior

to composing early drafts of a document. These researchers state that such breakdowns could possibly be avoided by process work directed toward nonacademic documents.

Based on this research, we designed course content in which students were encouraged to think critically about the needs of their readers and the subsequent content and structure of documents. We designed assignments in which students were asked to analyze the writing situations involved in extended nonacademic writing projects.

Collaboration

In this area, we reviewed research on collaboration via computers and found that for many researchers and instructors, a spontaneous outgrowth of work on computers has been increased student collaboration [10]. Much current research has also involved the study of collaborative learning in conjunction with CAI [4,11,12].

When students work collaboratively at computers, there is great variation as to how pairs interact. Carrier and Sales [4] taped and analyzed the verbal interactions of students working in pairs at computers. They used five categories to describe the pairs' interactions -- task specific, help seeking, help giving, transition and directions, and off-task -- and found that nearly one quarter of the pairs' interactions were off-task or did not relate to the instructional task. These results are in contrast to those of Trowbridge [13] who also videotaped groups of students working at computers. Trowbridge used an instrument that measured 19 observable behaviors and found that off-task behaviors were so infrequent that such a category was not useful for the analysis of students' interactions. Johnson, Johnson, and Stanne [14] also found that

students working in pairs at computers engaged in relatively few social or off-task remarks.

Based on this research, we designed CAI that encouraged students to work in pairs at computers. We defined collaboration as when students worked in pairs to prepare a written document, whether it be a rough or final draft. By investigating students' attitudes toward such collaboration, we could study whether students liked such a combination of CAI and collaboration that previous researchers discuss. We also could investigate if the students' use of CAI in conjunction with collaboration made their attitudes toward collaboration more favorable than those of students who collaborated but did not use computers.

Conferencing

Conferencing, along with collaboration, has been shown to enhance the social process of learning and writing [2,14]. Conferencing is a strategy in which students work in groups and share and critique each other's drafts. It is a technique that may minimize the potential isolation that CAI can have when students work individually at computers.

Most writing conference groups are arranged so that members of the group give copies of their rough drafts to the other group members. The members then write down their feedback and later meet in groups to discuss their comments. Sommers [3] feels that such conferencing techniques need to be used with CAI because different writers have different concerns about their writing, and conferencing allows writers the chance to share their writing and concerns.

Based on this research, we designed the course so that students could regularly

meet in conference groups to discuss their rough drafts or their CAI work. We therefore could examine students' attitudes towards conferencing and whether conferencing combined with CAI enhances students' attitudes towards conferencing.

Computers and CAI

Concerning computers and CAI, researchers and instructors currently use authoring systems in order to design course-specific software. These systems allow composition instructors to control the designing process and use effective instructional techniques when developing CAI.

Some CAI developed in the area of composition does not attempt to understand or evaluate the students' responses and has no limit on the size of the responses [15]. Kemp [16] feels that until artificial intelligence is perfected, the strength of computers in composition courses will be found in providing guidance in the generation and integration of ideas. He calls this "open-response" CAI and states that such CAI is characterized by an awareness of relationships of knowledge structures, purpose and procedure, unlimited response sizes, and directing or channeling ideas.

This channeling of ideas may prove to be one of the strongest attributes of the computer's use in composition instruction. Hawisher [5] examined the effects of word processing on the revision strategies of college freshmen and found that extensive revising using word processors did not improve the quality of the students' essays. She states that instead of focusing on revision, research should focus on whatever the students develop on the first draft, or the students' "first utterances."

Encouraging the quality of these first utterances may indeed be the clue to increasing the quality of students' writing. The use of computers in composition

courses to help students generate their first utterances is an exciting use of computers. Such a use dissipates the idea that students get all the answers from the computer after a draft has been computer-analyzed. Students may begin to revel in the fact that they are doing the thinking -- not the machine -- and this in turn might liberate their writing.

Based on this research, we decided to follow Kemp's strategies for designing open-response CAI, and have our students use CAI mainly to generate their first utterances or first drafts. We therefore could examine students' attitudes toward the use of this type of CAI and computers.

METHOD

The purpose of our research was to explore students' attitudes towards the course curriculum, collaboration, conferencing, and computers /CAI in relation to the type of environment in which students were taught. Students were taught in one of the following conditions:

- * 10 weeks of CAI in a computer environment (whole computer group)
- * 5 weeks of CAI in a computer environment and 5 weeks in a traditional classroom environment (half computer group)
- * 10 weeks of a paper version of the CAI in a traditional classroom environment (control group)

Subjects

Subjects were 122 students enrolled in a technical writing course titled Writing In Your Profession. Students in this course were juniors and seniors with diverse majors in the fields of agriculture, animal science, communications, design, forestry, horticulture, human relations, nutrition, retail merchandising, and wildlife management.

The purpose of this course is to increase students' skills in structuring and writing documents related to their professions. Students are taught how to construct memos, resumes, cover letters, and feasibility studies. The feasibility study is a major project and students write proposals, progress reports, and final reports as part of the feasibility study project.

The students in this study did not know that computers would be used in some sections before they registered for the course. Therefore, at the beginning of the course, students who would be using computers during the course were asked to indicate their previous computer experience as inexperienced, beginner, intermediate, or advanced. The students categorized themselves as follows: 31% as inexperienced, 32% as beginner, 30% as intermediate, and 7% as advanced. An ANOVA showed no significant differences in students' previous computer experience, $F(1,86) = 2.51, p = .117$.

CAI and Course Procedures

We used an authoring system known as ACCESS (A Computer Composing Educational Software System), developed by Don Ross and Sheldon Fossum at University of Minnesota, to develop the CAI for this course. The CAI included tutorials on the logical steps in developing a feasibility report -- planning, proposal, progress report, and a final report. Table I on the next page lists the main menus of this CAI. We designed the CAI so that it encouraged higher-level thinking versus drill-and-practice activities. The CAI gives information on writing a feasibility study, provides examples, and poses question prompts. It also includes a text editor that allows students to type in their immediate responses. The question prompts help students generate ideas and process work which they can directly rework into rough drafts.

Table 1
Main Menus for the Feasibility Study

Overview

Planning----	Subject	
	Audience	
	Purpose	
	Recommendations & Criteria	
	Effects	
	Projects----->	Agriculture
		Animal Science
		Forestry
		Horticulture
		Interior Design
		Nutrition
		Retail
		Merchandising
Proposal----	Notes	
	Introduction + Examples-->	Agriculture
	Criteria+ Examples----->	Animal Science
	Task/Time	Design
	Resources	Forestry
	Qualifications	Horticulture
		Human Relations
		Nutrition
		Retail
		Merchandising
		Wildlife
		Management
Progress ---->	Purposes	
Report	Content	
	Considerations	
Feasibility----	Overview	
Report	Annexes	
	Front Material----->	Letter of
		Transmittal
		Title Page
		Descriptive
		Abstract
		Table of Contents
		& List of Figures
		Introduction
		Factual Summary
		Conclusions
		Recommendations
		References

Three sections of students ($N = 57$) used the CAI and were taught in a computer environment for 10 weeks. These students met in a computer lab equipped with 16 IBMpc's, worked in pairs at the computers, and regularly handed in one assignment per pair. This collaborative style of learning was used the entire term. Students were also divided into conference groups to evaluate their peers' rough drafts.

Two sections of students ($N = 33$) also used the CAI, but were taught in a computer environment for only 5 weeks. These students also met in the computer lab equipped with IBMpc's, and they also worked in pairs at the computers and on assignments. Students in these two computer groups were given a Student Manual (Bloom, 1986) and a Student Manual Supplement which we developed, to use as references when working with the CAI.

Two sections of students ($N = 32$) acted as a control group. These students received a similar paper version of the CAI (screen shots) and were taught in a traditional classroom environment for 10 weeks. These students also regularly collaborated and conferenced.

For six months prior to the study, the three instructors who taught the seven sections met on a bi-weekly basis to coordinate the course content and discuss collaboration and conferencing strategies. The instructors also met bi-weekly throughout the duration of the study. To accommodate students outside of class, four computer labs were available for students to work in seven days a week, and computer assistants were available to answer students' questions concerning hardware and software.

Instrumentation

We used a five-point Likert scale to measure students' attitudes. The response categories for the Likert scale were "strongly agree," "agree," "undecided," "disagree," or "strongly disagree." Scores of 1 to 5 were assigned, taking the direction of the items into account. For example, a score of 5 was assigned to "strongly agree" for positive items and to "strongly disagree" for negative items.

Experts feel that it is important to tap diverse sources of opinions to generate an item pool of statements [17,18]. In order to design statements under the headings of course, collaboration, conferencing, and computers, we first reviewed the literature on these four

areas. From this search we found and used a scale developed by McCroskey and McCain [19] which examines the interpersonal attraction between two people. McCroskey and McCain feel that if two people are attracted to each other, they will communicate better. We inferred that if two people are attracted to each other, they will perhaps collaborate better. After discussing this with the other instructors, we decided to use McCroskey and McCain's scale to measure students' attitudes toward collaboration.

Second, we reviewed mid-term memos written to the instructors in which students stated their opinions about the course, collaboration, conferencing, and computers. These memos and the opinions, feelings, and beliefs that students had written down -- both negative and positive -- helped us generate additional items for the attitude inventory.

Third, to increase the face validity of the attitude inventory, the instructors involved in the study met and reviewed the first draft of the attitude inventory. We discussed each statement, decided whether each measured the variables of interest, and made appropriate additions, deletions, and revisions.

Fourth, experts in measuring social attitudes offer guidelines for developing statements that employ a Likert scale [17, 18, 20]. We followed these guidelines and worded each statement as clearly positive or negative with regard to the attitudinal object. We wrote clear and concise statements, avoided double-barreled statements, and used both negative and positive statements in order to prevent response setting.

Based on the above work, we generated 57 statements for the attitude inventory. Under the heading, Course, students responded to 10 statements such as "I will use the skills I learn in this class in my future career." Under the heading, Collaboration, students responded to 14 statements such as "Collaboration with my partner is valuable in helping me revise my work." Under the heading, Conferencing, students responded to 9 statements such as "Evaluating my peers' work increases my understanding of the writing process." To ensure that the students had the same definition of collaboration and conferencing that we had, definitions of these two terms were included with the instructions under these two headings. Collaboration was defined as "the work you did with one other person for your writing," and conferencing was defined as "the times you

divided into groups and gave feedback to your peers' rough drafts." Under the heading, Computers, students responded to 24 statements such as "The CAI helped me to do process work that I failed to do with pen and paper." The questions about computers were deleted for students in the control group as they did not use computers.

Finally, in order to gain more specific information, we included questions that did not employ Likert scales under the Course and Computer headings. For example, we asked students if they thought the assignments were too many, too few, or just right; how much time they spent outside of class working on the computer for this specific course; if the time allowed in class to work on CAI was too much, just right, or too little; and if they used the computer for pre-writing, drafting, revising, and editing. We also asked students to state specific frustrations they experienced when using computers and CAI.

The attitude inventory was administered at the end of the ninth week of the course. Students completed the attitude inventory during class. A memo accompanied the attitude inventory, explaining its purpose and assuring students of confidentiality in their answers.

RESULTS AND DISCUSSION

The purpose of this study was to examine students' attitudes toward a technical writing course and the use of collaboration, conferencing, and computers/CAI in relation to three types of environments in which students were taught: 10 weeks of CAI in a computer lab environment (whole computer group), 5 weeks of CAI in a computer environment and 5 weeks in a traditional classroom (half computer group), and 10 weeks of a paper version of the CAI taught in a traditional classroom (control group).

Table 2 on the next page presents students' mean total responses (and standard deviations) to the statements under the four headings. As can be seen, the three groups did not differ in their overall responses. However, the two groups who met in a computer environment did differ in their mean total responses under the computer/CAI heading. Those students who were taught in a computer environment for 10 weeks (whole group) generally responded more positively to the statements under this heading than did those students who were taught in a computer environment for only 5 of the 10 weeks

(half group).

Table 2

Mean Total Responses (and Standard Deviations) to the Statements under Course, Collaboration, Conferencing, and Computers/CAI Headings

	Whole	Half	Control
Heading	N=57	N=32	N=33
Course (Possible total=50)	37.65 (3.52)	35.97 (5.63)	37.94 (4.74)
Collaboration (Possible total=70)	54.90 (7.09)	52.03 (6.98)	53.27 (5.82)
Conferencing (Possible total=45)	27.97 (4.02)	27.77 (4.62)	28.82 (4.19)
Computers (Possible total=105)	74.74 (8.15)	64.22 (13.06)	— —

These totals did not show major differences between the groups. We therefore chose not to analyze all 57 statements on the attitude inventory. Instead, we reviewed the data, and chose to analyze six specific statements we felt instructors and researchers would find useful. Tables 3 and 4 on the next page present the Chi-squares and p -values for these six statements, and show the percentage breakdowns for the two significant statements. As can be seen, the three groups differed significantly on two of these statements. Chi-squares used as follow-up tests showed that on the statement concerning whether students felt they still had trouble organizing their thoughts when they write, the whole group felt less trouble in organizing their thoughts than the half group, $X^2 = 12.85$, $p = .01$, and the control group also had less trouble organizing their thoughts than the half group, $X^2 = 10.93$, $p = .02$. The whole and control groups did not differ.

Follow-up Chi-squares also showed that on the statement concerning whether students felt that evaluating their peers' work had increased their understanding of the writing process, the whole group felt more positive than the control group, $X^2 = 15.70$, $p = .003$. The whole vs. half and whole vs. control groups did not differ.

Table 3

Chi-squares and *p*-values on Six Statements Under the Course, Collaboration, and Conferencing Headings

Statement	X ²	<i>p</i>
Course		
I will use the skills I learn in this class in my future career.	5.48	.48
I still have trouble organizing my thoughts when I write.	18.61	.02 *
Collaboration		
I feel comfortable disagreeing with my partner, i.e., stating why I feel a certain way about a subject.	11.26	.19
Collaborating with my partner is valuable in helping me revise my work.	7.10	.53
Collaboration helps build my confidence in my writing skills.	5.90	.66
Conferencing		
Evaluating my peers' work, increases my understanding of the writing process.	17.70	.02 *

Table 4

Percentage Breakdowns for the Two Significant Course and Conferencing Statements

Statement	Response	Group		
		Whole	Half	Control
I still have trouble organizing my thoughts when I write.	SA	0	6	6
	A	23	6	24
	U	26	31	12
	D	47	38	55
	SD	4	19	3
Evaluating my peers' work increases my understanding of the writing process.	SA	27	13	6
	A	41	64	82
	U	20	10	3
	D	11	10	9
	SD	1	3	0

Again, under the Computer/CAI heading we chose not to analyze all 24 statements. Instead, we reviewed the data, and chose to analyze four specific statements we felt instructors and researchers would find useful. Table 5 presents the Chi-squares and *p*-values for these four statements under the Computers/CAI heading, and Table 6 on the next page shows the percentage breakdowns for the two significant Computer/CAI statements. As can be seen, those students in the whole group responded significantly more positively that, as a result of the computers/CAI, they now had more time to spend on revising, and that the CAI had helped them to do process work they would have failed to do with pen and paper.

Table 5

Chi-squares and *p*-values on Four Statements
Under the Computer/CAI Heading

Statement	χ^2	<i>p</i>
Computers		
I currently enjoy using the computer to write.	7.03	.13
By using the computer to write, I have more time to spend on revising my work.	17.71	.001 *
I plan to use a word processor to write assignments in future classes.	8.19	.08
The CAI helped me to do process work that I failed to do with pen and paper.	18.30	.001 *

Table 6

Percentage Breakdowns for the Two Significant Computer/CAI Statements

Statement	Group		
	Response	Whole	Half
By using the computer to write, I have more time to spend on revising my work.	SA	16	9
	A	54	25
	U	18	13
	D	7	28
	SD	5	25
The CAI helped me to do process work that I failed to do with pen and paper.	SA	18	13
	A	49	16
	U	12	13
	D	18	31
	SD	4	28

As stated earlier, we also asked students questions on specific aspects of the course. Table 7, below, presents percentage breakdowns for results from all three groups concerning their perceptions of the amount of work the course entailed. A Chi-square analysis showed that students differed in their responses to this question, $X^2 = 14.73$, $p = .005$. Chi-squares used as follow-up tests indicated that those students who met in a computer environment for the whole term responded significantly more positive than the half group in that they felt the amount of work and assignments were just right, $X^2 = 14.03$, $p = .0009$.

Table 7

Percentage Breakdowns for Results from all Three Groups on Amount of Assignments/Work

Amount of time	Group		
	Whole	Half	Control
Two little	2	0	0
Just right	70	31	52
Too much	28	69	48

Table 8 below presents percentage breakdowns for responses from the whole and half groups concerning four questions on their computer/CAI use.

First, the two computer groups were asked whether the amount of in-class computer time they had received was too little, just right, or too much. A Chi-square analysis showed that students differed in their responses to this question, $X^2 = 20.68$, $p = .0001$. Those students who met in a computer environment for the whole term felt that they had too little time to work on computers, while those who met in the computer environment for half the term were closely split between thinking the amount of time was too little, just right, or too much.

Table 8

Percentage Breakdowns for Results from the Computer Environment Groups on Amount of In-Class Computer Time, Writing Tasks, Hours of Outside Work, and End-of-term Computer Experience

Question	Group	
	Whole	Half
1. Time allowed for in-class computer work		
Too little	57	34
Just right	41	28
Too much	2	38
2. Number of regular writing tasks in which the computer was used		
0 tasks	0	2
1 task	5	12
2 tasks	16	17
3 tasks	11	16
4 tasks	68	53
3. Hours of outside-of-class computer work		
0-3 hours	14	42
4-6 hours	60	29
7-9 hours	26	23
10+ hours	0	6
4. End-of-term computer experience		
inexperienced	0	13
beginner	45	31
intermediate	50	44
advanced	5	12

Second, these groups were asked to indicate the number of writing tasks (pre-writing, drafting, revising, and editing) for which they regularly used computers. An ANOVA showed that groups differed in the number of tasks for which they had used computers/CAI, $F(1, 86) = 19.24$, $p = .0001$. Those students who met in a computer environment for the whole term regularly used computers for 3.42 of the 4 computer tasks; however, those students who met in the computer environment for half of the term regularly used computers for only 2.37 of the 4 tasks.

Third, these groups were asked to indicate the number of hours outside of class that they had worked on computers/CAI. An ANOVA showed no significant differences between the groups, $F(1, 86) = 1.21$, $p = .27$. However, a close look at the percentages indicated that the largest percentage of students in the whole group worked 4-6 hours per week outside of class, whereas the largest percentage of students in the half group worked 0-3 hours per week outside of class.

Fourth, as noted earlier, we had asked students at the beginning of the term to indicate their computer experience as inexperienced, beginner, intermediate, or advanced. On the attitude inventory we asked students to indicate their computer experience at the end of the term. While students again did not differ in terms of their estimations of computer experience, a repeated measures ANOVA indicated that the two groups significantly differed in terms of percentage gains from the beginning to the end of the course, $F(1, 86) = 8.90$, $p = .004$. Students in the whole group increased in their knowledge of computers by 64%, whereas students in the half group increased by 47%.

To summarize the results, students' overall attitudes toward the technical writing course, collaboration, and conferencing did not differ dramatically based on the three types of teaching environments in which students used the CAI. However, the two groups that were taught in a computer environment did differ in their attitudes toward computers and CAI.

From the subset of attitude inventory statements, we learned the following:

1. Organizing thoughts. Students who received CAI in a computer environment for 10 weeks (whole group) and those who received CAI in a traditional environment for 10 weeks (control group) felt that they had significantly less trouble organizing their thoughts than those students who received CAI in a computer environment for 5 weeks and in a traditional environment for 5 weeks (half group). This may suggest that implementing the use of computers/CAI into a course requires a full-term effort in order for the CAI to enhance students' writing processes.
2. Evaluating peers' work. Students in the whole group responded significantly more positive than the other groups that evaluating their peers' work had increased their understanding of writing as a process. This suggests that conferences in which students not only share drafts, but also have the means to put their members' feedback immediately on the draft of a document in front of them on a computer screen, promotes increased understanding of the writing process.
3. Time spent revising. Students in the whole group responded significantly more positive than those in the half group that, as a result of the computers/CAI, they now had more time to spend revising their writing. Perhaps because the CAI was designed to help students directly shape their "first utterances" or process work into drafts, students had stronger drafts to revise as well as more time to spend revising.
4. Process work. Students in the whole group responded significantly more positive than those in the half group that the CAI had helped them to do process work that they would have failed to do with pen and paper. In our estimation, this is the most encouraging result. Researchers note that the failure of a document in the world-of-work most often results from the author's failure to analyze his or her audiences, purposes, intended effects, and potential organization or structures [7,8,9]. CAI designed to aid students with such process work may ultimately help them in the workplace.

5. Amount of work/assignments. Students in the whole group responded significantly more positive than the other two groups that the amount of work for the course was "just right." Perhaps the CAI aided students with the coursework so as to lighten the course load. Or, because the CAI was designed to help students directly shape their "first utterances" or process work into drafts, the CAI may have strengthened the students' ability to deal with the course and assignments.

6. In-class computer time. Fifty-seven percent of students in the whole group felt that 10 weeks was too little time for computer use, and only 2% felt that this was too much time. In contrast, 34% of students in the half group felt that 5 weeks in a computer environment was too little time, and 38% felt that this was too much time. Apparently, a full-term implementation of computers/CAI into a course encourages students to want to use computers still more.

7. Computer writing tasks. Sixty-eight percent of students in the whole group used the computer regularly for all four main writing tasks: pre-writing, drafting, revising, and editing. Though only being taught in a computer environment for 5 weeks, 53% of students in the half group used the computer for all four writing tasks. These results suggest that students can indeed use computer/CAI for more tasks than traditional word processing and revising.

8. Outside-of-class computer work. The largest percentage of students in the whole group (60%) worked 4-6 hours per week on computers outside of classtime. In contrast, the largest percentage of students in the half group (42%) worked 0-3 hours per week on computers outside of classtime. With the reduced number of in-class computer use hours for the half group, one would have thought these results to be reversed. Apparently, increased exposure to computers/CAI, with the aid of an instructor, further encourages students to utilize CAI.

CONCLUSION

Balestri and Ehrmann [2] have commented on using computers in the classroom and evaluating their effectiveness. They state that "faculty are forced into experimentation and students are forced into watching the professor struggle with legitimate problem-solving. There is integrity in this type of education" [2, p.30]. In surveying students' attitudes, we found that despite the on-going problem-solving the students witnessed their instructors going through, students' overall attitudes towards the course, collaboration, conferencing, and computers was positive. This was an encouraging finding, assuring us that in designing a curriculum that involved the use of CAI, we did not bleakn our students' outlook on the area of composition. In contrast, students felt that we had involved them in the problem-solving processes, and that we had learned ways to further improve the course. And of major significance is the finding that students who met in a computer environment for ten weeks, indeed used the computer for more writing tasks -- pre-writing, drafting, revising, and editing -- than did those students who met in a computer environment for five weeks.

But how much time is needed to change students' attitudes? In response to yet another attitude inventory statement, students in the whole and half groups were undecided as to whether they preferred writing their rough drafts with pen and paper or with a computer. Further research is needed to examine how long it takes to make a significant change in students' attitudes toward the use of computers in their future writing and careers.

Design of a valid and reliable tool to consistently measure attitudes towards the use of computers in composition instruction is a challenge for researchers. Shaw and Wright [20] note that since different tools are often used to measure attitudes, research that has been done by different investigators often is not directly comparable. In our research review, we did not uncover any instruments that had been developed to measure attitudes towards the use of computers in composition. An extensive review of the literature and subsequent development of such a tool would be extremely useful to instructors, software designers, and researchers.

Our task was to evaluate students' attitudes towards the use of computers in their approach to the process of writing -- to examine whether certain environments create positive feelings towards computers/CAI and nurture a sense of the usefulness that computer technology may hold. Our results reveal a possible process to follow when designing tools to evaluate students' attitudes toward computer implementation. These results also indicate that computers/CAI can be used in a composition course and result in students having a favorable attitude towards this convergence of computer technology and instruction.

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